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ABSTRACT

This report discussed the conceptual and technical problems which constrain information systems (acquiring, classifying, storing, searching, retrieving) and shows how these are affected by certain characteristics of educational administration's knowledge base. The following constraints are identified: (1) the eclectic and multi-disciplinary knowledge base of educational administration makes it difficult to maintain quality in information products for acquisition, and to screen and purge low-quality products; (2) the lack of intra- and inter-disciplinary agreement on the meaning of terms exacerbates the problems of information product selection, screening, purging, and abstracting; (3) the low level of language specialization hinders controlling relevance in the information system; (4) the eclectic and multi-disciplinary knowledge base is further confounded when educational administration superimposes another layer of specialized language upon the information drawn from the social sciences; (5) large volumes of information products make indexing imprecise; (6) personalized, non-publication communication patterns do not characteristically exist among educational administrators, so that relevant knowledge-production proceeds at a slow rate. A final section reviews information science research literature relating to use by practitioners as opposed to use by knowledge-producers. (DAG)

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CONSTRAINTS OF INFORMATION SYSTEMS: CONCEPTUAL AND TECHNICAL PROBLEMS

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INTRODUCTION

The experience of preparing this paper has been a curious one. Over the years, I have been reasonably conversant with the literature in both educational administration* and information systems. Yet this is the first time, I believe, that I have made an overt attempt to juxtapose these two literatures in my mind as a means of considering the interactive effects which might result. And my reflections upon what is known about the seminal problems of information systems and the salient characteristics of educational administration brought to mind a chemistry textbook in my personal library. This book, circa, 1860, was written by a medical doctor and published in Boston. The text is divided into two sections of several chapters each. Section one, entitled "Ponderables," explicates those phenomena in chemistry for which the author felt reasonably assured of the theoretical and empirical bases. Section two, entitled "Imponderables," sets forth phenomena which the author felt were completely relevant but for which he has insufficient explanation. For example, the phlogiston theory of heat is included among the imponderables. Following the lead of this 19th century natural scientist, I have divided my paper into two primary sections.

Section I, "The Ponderables," reports the rather straightforward outcomes of interfacing the problems of information systems with the characteristics of educational administration. In this section, I have attempted to explore some of the conceptual and technical problems which are inherent constraints of information systems and to show how these are affected by the most salient characteristics of educational administration's knowledge base.

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* While I have focused attention exclusively on educational administration in this paper, the ideas and conclusions seem equally applicable to other specialized areas of education and to the field of education in general.

As one might expect, the complex and multi-disciplinary aspects of educational administration tend to exacerbate problems inherent in information systems.

Section II, "The Imponderables," explores ideas that I believe to be conceptual problems relevant to the knowledge base of educational administration and, therefore, relevant to the subject of this paper. However, like my predecessor who wrote about chemistry, I feel that our current ideas and explanations in this realm of consideration are insufficient.

SECTION I: THE PONDERABLES

The realm of formal information systems is diverse. Such systems range from the relatively simplistic arrangements individuals use to order their personal libraries, through sophisticated experimental projects, and to attempts at creating artificial intelligence systems. Regardless of their simplicity or complexity, though, all information systems seek to accomplish a reasonably standard set of functions. These functions are generally seen as processes or strategies for acquiring, classifying, storing, searching for, and retrieving information.

If severe restrictions are placed upon the kind and quantity of information acquired by a system, the technical and conceptual problems of classification, storage, search, and retrieval are considerable. But for any system to acquire an adequate variety and volume of information to operate meaningfully, the problems involved are legion. My intention, however, is not to produce exhaustive lists of these problems. Instead, I shall attempt to identify those fundamental problems inherent in information systems which seem to pose major constraints upon their operation and utility.

I shall then review some of the generally accepted characteristics of educational administration's knowledge base. By examining the fundamental

problems endemic to information systems in light of the knowledge-base characteristics of educational administration, problems of special significance can be inferred.

Fundamental Problems of Information Systems

The most pervasive concerns of information systems appear to be quality, relevance, time, and media capacity. In fact, the first three of these concerns serve as the primary criteria for judging solutions to nearly every conceptual or technical problem encountered in information systems.

Quality. Concerns about quality have to do with the relative "correctness" of the knowledge acquired as information and with maintenance of the integrity of information as it is processed by the system. Information systems do not generate original information. Instead, the information contained in these systems must be acquired from external sources. Furthermore, the information acquired represents knowledge of some kind, form, or level which is conveyed in some symbolic representation.

Knowledge-producers and knowledge-users are ultimately responsible for making judgments about the quality of knowledge conveyed by information products in their own disciplines. However, an effective information system must have mechanisms for operationally reflecting these judgments. The inclusion of critiques of information products is one such mechanism, but users of information systems do not characteristically want to receive low quality information in response to a request. So processes for screening or purging information judged inferior by disciplinarians are developed and implemented.

Quality control related to maintaining the integrity of information seldom becomes a problem in systems limited to retaining and manipulating the original documents as acquired. However, any system which produces information product surrogates--such as abstracts--or which transforms information

products to machine-readable form must be concerned with problems of maintaining the contextual, semantic, and linguistic integrity of the original.

Relevance. The most ubiquitous concern of information systems is relevance. Except for a few completely general-purpose systems--such as the Library of Congress--responsibility for judging relevance begins with the decision of whether or not to acquire a particular information product. Once any system decides to acquire an information product, the concept of relevance must operate as a primary criterion for judging every system process thereafter. The product must be classified according to some form of indexing system, it must be stored in such a manner that it can be accessed through any relevant index descriptor, the logic supporting indexor judgments about relevance must be systematic and documented so that search strategies can be retrospectively constructed, and ease of access upon demand must be assured.

Given the tremendous volume of information products being produced, no system can afford to acquire non-relevant information products. On the other hand, one global criterion by which information systems are judged is the comprehensive availability of relevant information products. Determining relevance for acquisitions is, then, a primary problem for nearly all information systems.

The heart of an information system is the indexing process. Any index descriptor not established in the indexing process is forever lost as a point of relevance except for trial-and-error search procedures or upon re-indexing. While the danger of "losing" an information product vis a vis a particular index descriptor is a concern, opposing concerns are the dysfunctions produced by citations of low relevance which may proliferate the volume of citations in a search. Much intellectual and technical effort has been expended in devising automatic (computer-based) indexing procedures, but most general-purpose systems retain manual procedures utilizing expert judgment by human indexors.

Studies and conceptual pieces devoted to highly refined automatic indexing abound in the literature. In a study conducted nearly a decade ago, one researcher concluded:

> Fully automatic text analysis and search systems do not appear to produce a retrieval performance which is inferior to that obtained by conventional systems using manual document indexing and manual search formulations. While the manual indexing and search formulations can lead to exceptionally fine results when the indexor and/or researcher are completely aware of the relationships between the stored collection and the user need, the search result may also be very poor when these conditions are not met. The automatic process, on the other hand, with its exhaustive input data and complex analysis methods, performs very poorly only rarely, and may often produce completely satisfactory retrieval action. (Salton, 1969, p. 70)

Some of the reasons why automatic indexing has not been more widely adopted are readily apparent. It requires that either the information product or a surrogate thereof be transformed to machine-readable form and this process is costly--especially for an established system with a large document base. Information system conceptualists and technical experts appear to be far from consensus on the "best" basis for automatic indexing. On the other hand, some experts (cf. Smith, 1976) argue the adequacy of existing conceptual and technical means for broad adoption of automatic indexing. My own impression, based upon recent literature analyses, is that automatic indexing remains more a dream than a reality for large-base information systems until some major conceptual breakthrough is achieved.

The relevance of information products obtained through search and retrieval is almost entirely limited by indexing precision. Of course, if information products are actually available in machine-readable form on a computer and if alternative, automatic indexing procedures are also incorporated in the system with an on-line terminal, a technically competent user has almost unlimited search flexibility. These conditions, however, are seldom met at the present time, and most information system users continue to be limited in search and

retrieval by the original indexing process. Even with such limitation, machine-searchable information bases are now commonplace, and it should be noted that machine searches have tremendous advantage over manual search, even with index restrictions. This is true because the rapidity of machine search permits high volume experimentation with different index items not practical in manual search procedures. In addition, machine searches make it practical to coordinate two or more index terms in a search and even to assign relative weights to various descriptors.

The problems associated with maintaining relevance from acquisition through retrieval remain seminal for information systems. But conceptual and technical advances over the last two decades--primarily computer applications--have markedly improved the relevance-maintaining capability of newer information systems.

Time. While time is important to any operation, it becomes a special concern for information systems in the form of: the time-lag between discovery of new knowledge and publication, the time-lag after acquisition for initial processing before system availability, and the time consumed by search and retrieval processes.

Research on how knowledge-producers obtain information demonstrates that the active knowledge-producers in a discipline actually obtain new knowledge from relevant colleagues prior to the publication of journal reports (Garvey and Gottfredson, 1976). The sources of such pre-publication information include informal meetings, formal presentations, and pre-publication papers.

In this era of "knowledge explosion," the delay between knowledge production and publication presents two time-related problems for information systems. One is that highly specialized information systems are being developed to provide quick turnaround information about new knowledge developments before

other information systems can acquire and process such information. These systems characteristically produce and sell on a proprietary basis superficial indexes and abstracts of pre-publication papers and of some journal publications. The "quickie" services specialize narrowly on specific fields of work, and their impact upon users and upon the more traditional information systems appears to be almost unexplored.

The time-lag between discovery of new knowledge and publication of information on such discoveries also makes it difficult to interest knowledge-producers in preparing information products which interpret or suggest applications of their discoveries. By the time the announcement of a knowledge discovery is published in journal form, the knowledge-producer has long since embarked upon new work, a fact which diminishes his/her interest in considering possible interpretations or applications of this discovery.

Time-lags incurred in processing information products, once acquired, create major problems for information systems. To insure relevance and quality of acquisitions and to insure accuracy of indexing once information products are acquired is time-consuming. At the same time, the need to get new information into the system for user availability presents an opposing constraint. The "knowledge explosion" coupled with exacting demands for insuring quality and relevance in processing new inputs pose major time-related problems for information systems.

Finally, time is a primary criterion used for judging search and retrieval procedures. Computerized search procedures have reduced to tolerable limits the real-time required for extensive literature searches. However, the computer-time required for highly sophisticated search procedures quickly becomes economically prohibitive for on-line systems of great flexibility.

While time problems do not exercise the magnitude of constraint that relevance and quality problems do, time is an important factor in making many decisions about information system operation.

Media Capacity. Information systems are almost exclusively devoted to the printed word as the medium of intellectual exchange. Attention to the single medium of print is so commonplace that one seldom finds any reference to other media in much of the information systems literature. It seems that almost all studies of and proposed models for information systems assume the exclusivity of print as the medium of exchange--this is true to such an extent that media capacity limitations are seldom mentioned. Yet the constraints imposed by this limitation in a society oriented to non-print media will, it seems, become increasingly felt. In addition, media handling limitations will produce vastly different constraints for different fields of knowledge and different users. For example, teachers seeking new instructional methods will find the ERIC system more constraining than will educational researchers.

Summary of Seminal Problems. All information systems share fundamental problems endemic to their very nature. The total number of such problems at the operational level is myriad, but at higher levels of generalization, the seminal problems are relatively manageable in number. Those identified here include:

(1) Problems of information product selection and acquisition arising from the need to insure quality of knowledge contribution (correctness);

(2) Problems of screening or purging information products judged low in quality after inclusion in the system;

(3) Problems of maintaining integrity of information in information product surrogates such as abstract and machine-readable forms;

(4) Problems of limiting acquisitions to those most relevant information products for a system's purposes;

(5) Problems of devising and operating indexing procedures which insure best indexing for the particular system (the knowledge-base and search procedures will be important factors);

(6) Problems of selecting an adequate but limited number of highest relevance index terms for an information product;

(7) Problems of devising and implementing specialized search procedures to produce an optimum volume of information products of greatest possible relevance;

(8) Problems of time-lag between discovery of new knowledge and information product availability;

(9) Problems of time-lag between information product acquisition and system availability of these products due to processing requirements;

(10) Problems related to time required for individual, specialized searches (cost of machine-time required for complex searches becomes a factor); and

(11) Problems of handling information products presented in media other than printed-word documents.

Characteristics of Educational Administration

Educational administration is commonly thought of as a field of study, a practice, or a profession. Few would argue that educational administration is a discipline in the same sense that natural sciences are considered disciplines. Yet educational administration does have some characteristics similar to those of the disciplines. There is, for example, a reasonably well-defined literature directly relevant to the field, and there is a core of knowledge-producers who engage in scientific study of the field. Still, most would agree that educational administration is more a multi-disciplinary and eclectic field than it is a discipline.

Multi-Disciplinary Knowledge Base. While there is a literature specifically related to educational administration, it does not represent the pervasive knowledge base of the field. Instead, knowledge relevant to educational administration can be found in at least four social science disciplines:

economics, political science, psychology, and sociology. Also, those who hold an administration qua administration point of view consider knowledge from the field of public and business administration directly relevant.

The knowledge base of educational administration is, thus, an accumulation of knowledge drawn selectively from a number of other disciplines. Not only is there no single, integrated knowledge base, then, but the selection of of relevant knowledge from these other bases is not systematic. In addition to this lack of systematic structure, one must note that the disciplines from which this knowledge base is drawn are the social sciences. The characteristics of language specialization in these sciences are much less well-developed than those of the natural sciences.

Knowledge-Producers. Educational administration does have an identifiable core of knowledge-producers. But these researchers represent only a fraction of the active producers of knowledge relevant to educational administration. Other knowledge-producers of primary relevance are associated with the various social science disciplines and possibly with other fields of administration.

Unlike the well-integrated, knowledge-producer community associated with a particular discipline, the knowledge-producers of primary relevance to educational administration are both physically and intellectually disbursed. Their status is dependent upon the disparate norms of separate research communities, and their conceptual bases and specialized languages differ. Except for the community of researchers who explicitly identify educational administration as their primary reference group, the knowledge-producers have little motivation to be concerned with the implications of their work for educational administration. Their concerns are, instead, for advancement of the knowledge bases of their respective disciplines.

Summary of Salient Characteristics. This brief overview of characteristics peculiar to the knowledge base and knowledge-producer community of educational

administration omits many important features of the field. However, it does highlight the characteristics which seem most salient to consideration here; these are:

(1) The knowledge base is eclectic and multi-disciplinary; thus, it lacks the logical structure characteristic of that of disciplines and there are no systematic procedures for determining relevance of new knowledge to the field;

(2) The disciplines relevant to the field are social sciences which are themselves severely limited by low levels of language specialization;

(3) The knowledge-producers who orient specifically to educational administration lack personal interaction with other knowledge-producer communities of relevance to the field; and

(4) The field depends upon multiple communities of knowledge-producers, each of which orients to its own discipline with little motivation toward inter-community communication.

Inferences Drawn About Special Constraints

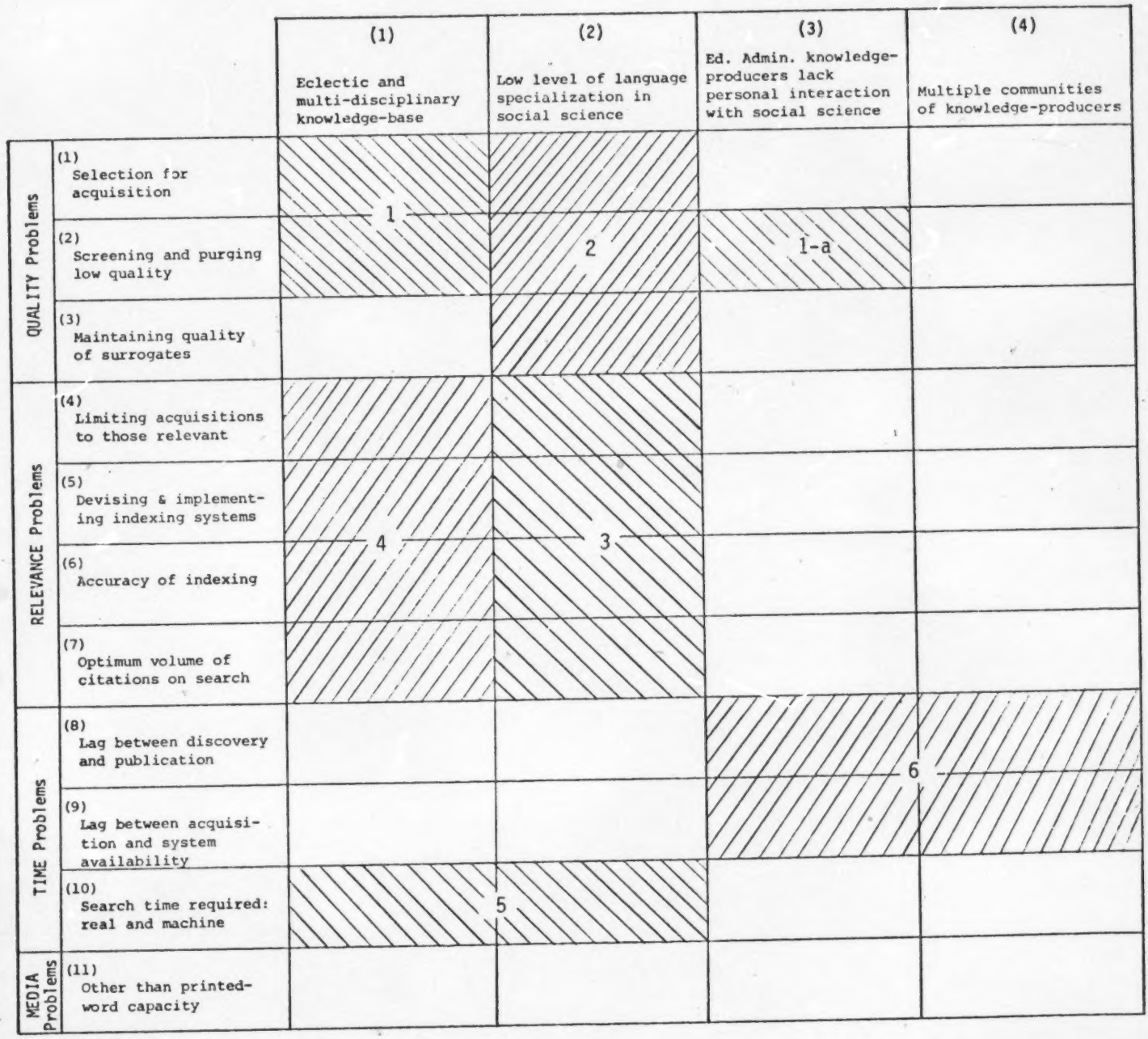
In the first part of this section, problems endemic to information systems were explored at a relatively high level of generalization. The second part of this section explicates what are thought to be the most salient features of educational administration, viewing the field from the perspective of its knowledge base and knowledge-producers. To examine interactions between the problems of information systems and the characteristics of educational administration, these problems and characteristics are arrayed in a simple matrix--see Chart I.

Each of the 44 possible interactions depicted in Chart I might be analyzed separately. However, I have found it more useful in my own thinking to identify larger areas of interaction. These areas are shaded and numbered on the chart. Special constraints of information systems inferred by this juxtaposition are described below.

Constraint #1. The eclectic and multi-disciplinary knowledge base of educational administration makes it difficult to maintain quality in selecting

CHART I. Exacerbation of Problems

The shaded areas represent interactions where problems endemic to information systems are exacerbated by the characteristics of educational administration.


(1) Eclectic and multi-disciplinary knowledge-base
(2) Low level of language specialization in social science
(3) Ed. Admin. knowledge-producers lack personal interaction with social science
(4) Multiple communities of knowledge-producers
QUALITY Problems
(1) Selection for acquisition
(2) Screening and purging low quality
(3) Maintaining quality of surrogates
RELEVANCE Problems
(4) Limiting acquisitions to those relevant
(5) Devising & implementing indexing systems
(6) Accuracy of indexing
(7) Optimum volume of citations on search
TIME Problems
(8) Lag between discovery and publication
(9) Lag between acquisition and system availability
(10) Search time required: real and machine
MEDIA Problems
(11) Other than printed-word capacity
1
2
1-a
3
4
5
6

information products for acquisition and to screen and purge low-quality products. Because educational administration does not have a primary knowledge structure of its own, any information system devoted to educational administration will be required to explore knowledge generated in at least four disciplines, as well as the field or fields of administration, to acquire appropriate information products. Furthermore, relatively fewer critiques regarding the value of new knowledge with respect to educational administration will be available in the literature.

This latter condition also reflects the relatively limited size of the community of knowledge-producers who identify primarily with educational administration (see 1-a on the chart). There simply are too few knowledge-producers in educational administration to adequately survey all the literature which may contain relevant knowledge, and there appear to be few incentives encouraging these professionals to provide syntheses of multi-disciplinary knowledge.

Constraint #2. Language specialization in the social sciences is not highly developed. Even within each of these disciplines, the same words identified as "concepts" lack commonly agreed upon definitions. And inter-disciplinary agreements on definitions of terms pose even greater problems. This basic lack of intra- and inter-disciplinary agreement on the meanings of specialized terms exacerbates all information system problems related to maintenance of quality in information product selection, screening and purging, and preparing surrogates. Since the educational administration knowledge base depends in large measure upon knowledge generated by these disciplines, the qualitative limitations imposed by their language specialization are constraints.

Constraint #3. All aspects of maintaining relevance in information systems are adversely affected by the level of language specialization

associated with the educational administration knowledge base. Since the conceptual and technical means of maintaining relevance in each phase of information processing are dependent upon commonality of language usage, the "softness" of language frustrates every form of relevance control yet devised.

Constraint #4. The eclectic and multi-disciplinary nature of the educational administration knowledge base further confounds the relevance-maintaining problems which are already adversely affected by the lack of language specialization. One dimension of this further confounding arises because educational administration sometimes superimposes another layer of specialized language upon the information drawn from the social sciences. Another more obvious way in which this problem is confounded is that educational administration draws on so many disciplines for its knowledge, and the addition of each discipline simply compounds the fundamental language problem.

Constraint #5. Time required for the systematic search of stored documents is directly related to the volume of possible documents available and to the conciseness of index descriptor relevance. The explanations offered regarding constraints one through four provide reasons that we might expect searches in educational administration to be made on large volumes of information products and that the index descriptors for these knowledge-products will be imprecise. Under the conditions described, it seems reasonable to expect searches of this knowledge base to be time consuming, in either the real-time of manual search or the machine-time of automated search.

Constraint #6. If we extrapolate from what we know about knowledge-producers as users in the natural sciences, we might expect that knowledge-producers in any particular discipline tend to rely almost exclusively on face-to-face, conference, and pre-publication communication in getting information for further knowledge-production activities. We may also assume that such communications enhance the rate of new knowledge discovery. When we consider the multiple

knowledge-producer communities involved in creating new knowledge relevant to educational administration, we must assume that many of the more personalized, non-publication communication patterns do not characteristically exist; so it seems reasonable to conclude that knowledge-production relevant to the educational administration knowledge base proceeds at a slower rate than does the growth of knowledge in a discipline. Recognizing that the knowledge-producers who orient particularly to educational administration must, therefore, depend upon information systems as their source of new knowledge from the array of relevant disciplines, we can only conclude that their productivity is retarded by this factor. Furthermore, it becomes apparent that knowledge-production in educational administration is especially restricted by any information system time-lags encountered in obtaining new knowledge-products or in making them available.

The foregoing analysis of the constraints of information systems as conceptual and technical problems is limited in many explicit and implicit ways, but one limitation seems especially worthy of note. Throughout this section of the paper, little has been said about practitioners as users of information systems. One outcome of this is that the almost exclusive limitation of information systems to the printed word do not appear to be especially confounded by educational administration. It takes little imagination, however, to discover important ways in which information systems' reliance on printed-word media restricts their utility and attractiveness for practitioners in education.

SECTION II: THE IMPONDERABLES

As I pursued the information science literature in preparing this paper, I was struck by the fact that this literature deals almost exclusively with scientific knowledge. Many works explore how scientific knowledge is generated,

others consider communications mechanisms--both formal and informal--employed by scientists, and still others worry about highly refined models for accurately carrying out the necessary information system functions of indexing, storing, and retrieving such knowledge. This conceptual and experimental work is impressive for its insightful accomplishments. Yet I found it disquieting that the research, model building, and speculation of this literature included very little consideration of information system users, other than the knowledge-producers themselves.

It appears that most of the well-documented user studies are concerned with how well suited information systems are to the needs of scientists as they engage continuously in the cyclical processes of knowledge-generation and knowledge-use. The veracity of this generalization--which is based upon admittedly unsystematic sampling--seems to be supported by more systematic literature reviews in the information science field. As examples: Line (1969) noted that the number of studies of natural scientists' information needs was overwhelming when contrasted with the small number of studies of social scientists' needs, and Paisley (1965) in attempting a review of studies on the flow of behavioral science information concluded that no literature existed to review. More recently, Faibisoff and Ely (1976, p. 7) assert that the literature regarding information needs of professionals is scanty and that "...the studies are too limited in number and scope to draw inferences regarding the information needs of professionals in general or even about specific professions."

Faibisoff and Ely report only one exception. Studies on engineers' needs for information are well documented enough to draw some generalizations. Here, Faibisoff and Ely assert that "...scientific literature is generally of little use to the engineer since natural scientists write predominantly for other scientists" (1976, p. 7). And further, citing Marquis and Allen (1966),

Faibisoff and Ely assert that scientists and engineers are concerned about different subjects with very few interests being commonly held.

Continuing my search of the information systems literature, I wondered increasingly if the conceptual and technical problems associated with information systems--even tempered by a conceptual transformation to a multi-disciplinary field--had applicability for any but the researcher in educational administration. I noted the exhortation of A. Gralewska-Vickery (1976) in the introduction to a report, "Communication and Information Needs of Earth Science Engineers":

> Not till well into the twentieth century were the mechanics of materials and geology applied seriously to earth engineering. Even now, much craft knowledge is still transmitted by apprenticeship and word-of-mouth. Those historical traditions must be borne in mind as we examine technical communication among earth science engineers. (p. 251)

Gralewska-Vickery reemphasizes the gulf between practitioner-engineer and researcher-engineer by including the following quotation from an interviewee:

> I think the research man is one who is prepared to be methodical and has a strong tendency to require security in all things. The experiments done by a scientist must be recorded, giving the circumstances under which they have been done. This is done in order that other scientists could repeat the experiments and get the same results. These experiments are done to confirm hypotheses which are anticipated before the experiments started. The results are published and known to everybody who is active in this particular field of science. The practitioner is more rough. His satisfaction comes from seeing things done quickly, even if the results are not perfect or if he has to cut corners on the way. The research-engineer tends to be a perfectionist and is much less cost conscious. The practitioner lives in a situation of compromise in which the most important thing is the completion of work, bringing it to a boiling point. (p. 263)

The distinction drawn here between practitioner-engineer and researcher-engineer seems to me not unlike the distinction we commonly draw between the practitioner of educational administration and the researcher of educational administration or the social scientist researcher in general.

Gralewska-Vickery, following our well-established cultural tradition, goes on to explicate a complex system of linkers, consultants, and in-service training as means of transforming the knowledge of engineering science into forms palpable to the practitioner-engineer. The study's recommendations for improving inter-engineer communication ignore completely any procedure for documenting the knowledge of practice which is said to have been transmitted for 5,000 years by word of mouth and apprenticeship from one generation of engineers to another.

This work, somehow, drew in bold relief for me questions about why the knowledge of the scientist is generally accepted as superior to that of the practitioner, or why our concern always seems oriented to gathering scientific knowledge and transforming it to meet the practitioners' needs. Would it not be equally plausible that the practitioner has knowledge gained from experience which is of value equal to that of the scientist? Isn't it possible that practitioners' knowledge is not simply an inferior version of scientists' knowledge, instead, that it is inferior only in that it is not documented? Could it be that practitioners' knowledge is substantively different, but of equal value, and something we should learn to document in order to achieve an adequate knowledge base?

Suddenly I was filled with the joy of a personal achievement--an insight which began to explain my intuitive uncertainty about information systems and their interface with educational administration!

As I continued my literature search, I found that my insight was not original. Cassigy (1966) had, I believe, explained the same finding more eloquently. He draws a distinction between scientific knowledge, understanding, and wisdom. Scientific knowledge is viewed as resulting from the activity of analysis. Understanding is viewed as resulting from the activity of synthesis. Wisdom is then defined as knowledge and understanding of both scientific knowledge

and experience. Cassidy asserts that "...excessive specialization, while it may give deep understanding, does not confer wisdom..." and, further, he warns that wisdom is opposed by the fragmentation of knowledge and experience.

More than a dozen years ago, Willower (1964) offered a conception of educational administration remarkably parallel to Cassidy's more general characterization. Willower argued that the "...blending of knowledge, values, and method, of the rational and the emotional, of theory and practice might be called wisdom or judgment when found in the practitioner or professor."

In an attempt to depict what he describes as the emerging discipline of "epistemo-dynamics," Kochen (1969, p. 186) uses Cassidy's conception to propose a logical structuring of the new discipline so that "...the 'growing literature' organizes knowledge analogously to the way a learned, by creating models of his relevant environment, is able to take increasingly effective actions." He envisions in the next few decades (1) computer-aided bibliographic control for tracing, detecting, and aggregating mutually-relevant bibliographic items, and (2) computer aides to individual decision-making to '...enrich our capabilities for posing and solving real-life problems." Throughout his considerations, Kochen (1969, p. 187) poses as a key problem the question of "...whether the growth of [scientific] knowledge is paralleled, stably, by the growth of wisdom." Or, he asks, "...do growth of [scientific] knowledge and growth of wisdom diverge?" Kochen (1969, p. 196) concludes his proposal for the discipline of "epistemo-dynamics" with a plea that this discipline "...be developed in the hands of both scientists and humanists..." and that it not be "...fragmented like most others." To this end, he offers it as a means of achieving a scientific understanding of science itself.

I find little in the information science literature subsequent to the 1969 publication of Kochen's paper to indicate that the discipline he envisioned is taking form. Nor do I find evidence in other fields of serious attempts to

integrate scientific knowledge and experiential knowledge as equal partners. Possibly this is because we reject the basic argument of valuing equally the knowledge of science and the knowledge of experience. Or possibly, we accept the merit of this idea but, like C. P. Snow, resign ourselves to a continuing world of "two cultures."

In conclusion, while many constraints of information systems pose interesting and important conceptual and technical problems which limit the utility of these systems in fields such as educational administration, I believe the greatest constraints stem from our inability to recognize the important contribution of experience to the fundamental knowledge base of our field. Until we seriously study what experience teaches and document this as a legitimate partner of our scientific knowledge, researchers will continue to communicate only with researchers and practitioners will continue to communicate only with other administrators. We may achieve some modicum of success by engaging in patchwork and piecemeal efforts at linking scientists and practitioners, but such success will be limited. The real knowledge base of experience from our field will elude our literature and our preparatory programs while it is passed haltingly, uncertainly, and undocumented from the wise practitioners of one generation to the heirs-apparent of the next. We will only know that this miraculous, intuitive process has been accomplished by retrospectively viewing new practitioner-leaders as they emerge and succeed.

There are, of course, those in our field who are addressing the problems of documenting the experiential knowledge base of practitioners. For example, Harry Wolcott (1973) has developed, taught, and published ethnographic procedures for documenting some aspects of the school administrators' knowledge gained from experience. In the broader field of general education, the lively interest of Kohlberg's "Stages of Moral Judgment" (cf. Gibbs, 1977) and a recent article by Boyer and Kaplan (1977) both seem to be examples of a growing

interest and concern that we in education attend more systematically to the problems of morals, ethics, and values as they reflect an important aspect of our experiential knowledge base.

I am forced to conclude that for educational administration, the most important constraint of information systems arises as a problem of our own field and not as a limitation of information systems per se. Until we learn to systematically document and report the important knowledge of educational administration gained through experience, all information systems--regardless of their sophistication--will be devoid of information stemming from this crucial knowledge base.

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